

REMARKS

Applicant would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office action, and amended as necessary to more clearly and particularly describe the subject matter which applicant regards as the invention.

In the Office action, claims 1 – 19 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over the claims of co-pending Application No. 12/603,116. In response, a Terminal Disclaimer is filed herewith. Accordingly, the grounds for the provisional rejection have been removed.

Further, claims 1 – 12 were rejected under 35 U.S.C. 102(b) as being anticipated by Takenaka (U.S. Patent No. 5,459,659). The rejections are traversed for the following reasons.

With respect to claim 1, a control device for a legged mobile robot includes a permissible range setting means and a desired instantaneous value determining means. The permissible range setting means sets a permissible range of a vertical component of a floor reaction force moment (or a component of the floor reaction force moment in floor surface normal line direction) to be applied to the robot during operation following a desired motion and desired floor reaction force. The desired instantaneous value determining means determines instantaneous values of the desired motion and the desired floor reaction force based on a difference between a desired state amount about a vertical axis (related to robot posture) and an actual state amount and the permissible range. The instantaneous values are determined

such that a deviation between a floor reaction force moment balancing with the desired motion of a dynamic model and a floor reaction force moment of the desired floor reaction force approximates a difference to zero while having the vertical component of the floor reaction force moment fall within the permissible range.

As discussed on page 5, line 25 – page 6, line 6 of the present application, failure to consider a magnitude of a floor reaction force moment vertical component can lead to an undue increase in friction, which can lead to a spin (a state in which a yaw angular velocity of an actual robot deviates from a desired yaw angular velocity). Accordingly, the instantaneous values relate to both a desired motion and a desired floor reaction force, particularly, to a vertical component of the floor reaction force moment. As such, the posture of the robot is stably maintained while the desired floor reaction force is controlled so as to prevent the robot from spinning and falling as a result of the spinning.

The Takenaka patent is concerned with the stabilization of a legged mobile robot. Particularly, Takenaka discloses that a legged mobile robot is stabilized by a system that generates a desired walking pattern of the robot such that a floor reaction force moment acting on the robot when the robot's leg comes into contact with the floor is at a desired position. By controlling (e.g., detecting and correcting) the position at which the floor reaction force moment acts on the robot, an inclinatory error of the robot's trunk is controlled (e.g., detected and corrected). Takenaka discloses that the position at which the floor reaction force moment acts on the robot is controlled by shifting the ankle joint of the robot and/or the landing position of the robot foot.

With reference to Figs. 2 and 3 thereof, Takenaka generally discloses a

benefit of the system being achieved by widening the range within which the actual and target ZMP positions can be shifted (in Fig. 2, the range is limited to the foot region X_{sole}). Accordingly, Takenaka discloses that the ability to maintain a stable robot posture during walking is improved. However, it is noted that Takenaka is only concerned with changing the position at which the floor reaction force moment acts on the robot.

Insofar as Takenaka discloses a system for stabilizing a legged mobile robot that considers a floor reaction force, it is submitted that the Takenaka system is only concerned with correcting a posture of the robot by controlling the position at which the floor reaction force moment acts on the robot. Takenaka is not concerned with controlling both a posture of the robot and a vertical component of a floor reaction force moment of the robot. Rather, Takenaka is only concerned with a position that the floor reaction force moment acts on the robot as such position is related to the robot's posture.

In this regard, it is noted that Takenaka is silent as to a desired floor reaction force moment, focusing only on a desired position of a floor reaction force. Moreover, though mentioning a floor reaction force moment, Takenaka is silent as to a consideration of a vertical component of a floor reaction force moment. In this vein, as a vertical component of the floor reaction force is not considered, Takenaka does not teach setting a permissible range for a vertical component of the floor reaction force and does not teach determining an instantaneous value having a vertical component of a floor reaction force moment that falls within the permissible range.

Thus, Takenaka fails to teach a **"permissible range setting means for**

setting a permissible range of a restriction object amount, the restriction object amount being a vertical component of a floor reaction force moment or a component of the floor reaction force moment in floor surface normal line direction to be applied to a robot in operation, following the desired motion and the desired floor reaction force", as required by claim 1. Further, Takenaka fails to teach a "desired instantaneous value determining means for determining, on the basis of at least a difference between a desired state amount related to a posture of the robot about a vertical axis or about a floor surface normal line axis and an actual state amount of the robot and the permissible range, instantaneous values of the desired motion and the desired floor reaction force such that a deviation between a floor reaction force moment balancing with the desired motion on the dynamic model and a floor reaction force moment of the desired floor reaction force approximates the difference to zero, while having the restriction object amount, which is associated with the desired floor reaction force, fall within the permissible range", as is also required by claim 1.

Accordingly, Takenaka fails to teach each and every feature of claim 1 and therefore does not anticipate claim 1. Reconsideration and withdrawal of the rejection of claim 1 is requested. Further, claims 2 – 5 depend from claim 1 and are therefore also considered allowable over Takenaka.

With respect to independent claims 6 and 10, it is noted that these claims also include the above features discussed with reference to claim 1. As such, claims 6 and 10 are considered allowable over the art for the same reasons as those presented above for claim 1. Accordingly, reconsideration and withdrawal of the

rejections of claims 6 and 10 is requested. Further, claims 7 – 9, 11, and 12 depend from one of claims 6 and 10, and are therefore also considered allowable over the art.

Claims 13 – 19 were rejected under 35 U.S.C. 103(a) as being unpatentable over Takenaka in view of Mueller et al. (U.S. Patent No. 6,560,539). The rejections are traversed for the following reasons.

Claims 13 and 14 depend from claim 10 while claims 15 – 19 depend from claim 1. Accordingly, to render claims 13 – 19 obvious, the cited art must teach or suggest each and every feature of claims 1 and 10. In this vein, the shortcomings of Takenaka with respect to claims 1 and 10 (discussed above) must be remedied by the Mueller patent to render the claims obvious.

The Mueller patent is concerned with a method and device for determining a speed of a wheeled vehicle. While the Mueller patent makes mention of angular momentum, yaw rate, and slippage, Mueller does not disclose consideration of a floor reaction force vertical component. Accordingly, as with the Takenaka patent, Mueller fails to teach or suggest the permissible range setting means and the instantaneous value determining means of claims 1 and 10.

Thus, the combined references fail to teach or suggest each and every feature of claims 1 and 10. As such, claims 13 – 19, which depend therefrom, are not rendered obvious by the cited art. Reconsideration and withdrawal of the rejections is requested.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is

invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. SAT-16280.

Respectfully submitted,

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